

# Clinical analysis on argon plasma coagulation (APC) under painless colonoscopy for treatment of patients with colorectal polyp canceration

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**Abstract. – OBJECTIVE:** To investigate the clinical effects of argon plasma coagulation combined high frequency electric knife in treating patients with colorectal polyp canceration.

**PATIENTS AND METHODS:** 56 patients diagnosed with colorectal polyp canceration were divided into control group (n=23) and observation group (n=33). Patients in the control group were treated with high frequency electric band ligation electroexcision while patients in observation group were treated with argon coagulation combined high frequency electric knife therapy. The patients were followed up for 6 months and, then, compared for their clinical effects and prognosis.

**RESULTS:** The average diameter of the polyp, the ratios of sessile and flat polyps in observation group were significantly higher than those in the control group with  $p<0.05$ . While the differences in the ratio of adenomatous polyp, middle and high differentiated as well as leafless polyps between the two groups had no statistical significance with  $p>0.05$ . Further, the differences in operation completion rate and polyp resection rate at one time in observation group was significantly higher than those of control group while operative complication rate and operation time was significantly lower than those in the control group with  $p<0.05$ . Also, the differences in recurrence in situ and recurrence time did not differ significantly between the two groups.

**CONCLUSIONS:** Treating colorectal polyps by argon plasma coagulation combined high frequency electric knife could extend polyp resection indication, along with improvement in the operation effect and reduction of complications.

#### Key Words:

Painless colonoscopy, Argon plasma coagulation, High frequency electric knife, Colorectal polyp canceration.

## Introduction

The incidence and mortality of colorectal cancer ranked the second or the third of all malignant tumors in developed countries. The development of colorectal cancer kept to the evolution law put forward by Morson, from normal mucosa to adenoma then to adenocarcinoma. Early monitoring and timely treatment could effectively prevent adenocarcinoma<sup>1</sup>. At present, the electronic colonoscope is the first choice for clinical screening, which not only has the advantages of high precision and high accuracy, but also could support intervention treatment. Colonoscopy examination and treatment under painless general anesthesia had a quite a few advantages such as fewer sufferings of patients, short time, quick recovery, fewer complications, low disturbance on the operation and more complete treatment, etc. That's why it has been widely used in clinic. High frequency electric resection via electron colonoscopy has become the maturest and most popularized endoscopic treatment in nowadays clinic. Combining high frequency electric resection and argon plasma coagulation (APC) together could improve the safety of operation and achieve complementary advantages<sup>2</sup>. In our study, we have further investigated the clinical effects of argon plasma coagulation (APC) combined high frequency electric knife in treating patients with colorectal polyp canceration, thus providing a reference basis for clinical therapy.

## Patients and Methods

### Patients

A total of 56 patients that were diagnosed with colorectal polyp canceration in our hospital from

October 2013 to October 2014 were enrolled. Implemented endoscopic biopsy on the patients who were highly suspected with polyp canceration, was sent for pathological examination. Pathological criteria of canceration on the basis of adenoma atypical hyperplasia, nucleus in partial regions had different degrees of enlargement and became rounded or oval, the chromatin in the nucleus was coarsened and accompanied with apparent nucleolus or had apparent discriminable pathological mitotic images. The polarity of cell nucleus was in disorder, mucus secretion of epithelial cells decreased, the glandular tube was irregular, accompanying with common wall and sieve structure, or epithelial cells of glandular tube showed different degrees of hyperplasia and formed reticulate structure (cell bypass). Once the above pathological changes appeared, it then indicated that adenoma has developed into canceration.

#### **Selection Criteria for Patients**

The inclusion criteria were: 1) Patients at or above 18 years and below 80 years 2) Patients that conformed to the diagnostic criteria of polyp canceration 3) Patients that were treated by operation for the first time. The exclusion criteria were: 1) Patients confirmed with colorectal cancer, secondary colorectal tumor, complicated by tumors in other organs. 2) Patients with ulcerative colitis, Crohn disease, irritable bowel syndrome, colorectal infection, perforation, bleeding 3) Patients with familial hereditary intestinal polyp, incomplete removal of colorectal polyp 4) Patients in pregnancy, complicated by severe dysfunction of heart, liver and kidney and other organs, patients that could not tolerate operation or patients with poor compliance or refused this research.

After obtaining the approval of the Ethics Committee of Third Hospital of Jilin University and the informed consent of the patients as well as their relatives, all of the enrolled cases were divided into control group (n=23) and experimental group (n=33) according to their sequence of admission. The control group consisted of 12 males and 11 females, aged from 37 to 68 years old and on average  $49.5 \pm 12.3$  years old; with a course from 1-month to 3-years and on average  $(10.5 \pm 2.4)$  months. The number of polyps was from 1 to 5 and on average  $(2.4 \pm 0.6)$ . The remotest polyp was 5-18 cm from crissum and on average  $(10.3 \pm 4.2)$  cm. The experimental group includes 18 males and 15 females aged between

36 to 73 years and on average  $(52.3 \pm 13.4)$  years old with a course from 2-month to 4.5-year and on average  $(12.6 \pm 2.5)$  months. The number of polyps was from 1 to 6 and on average  $(2.6 \pm 0.7)$ , the remotest polyps were 5-18 cm from crissum and on average  $(11.5 \pm 3.8)$  cm. The difference between the two groups on baseline materials was not statistically significant ( $p > 0.05$ ).

#### **Experimental Methods**

Patients in the control group were treated with high frequency electric band ligation electroexcision. Patients were examined by Olympus Series 240 and Series 260 electron colonoscopy (Tokyo, Japan) and by using high frequency electric knife (ERBE, Tubingen, Germany, high frequency electric generator) forced coagulation. The initial power was adjusted at 30W and the mode was at ENDO CUT. The right snare point was selected for treatment, first the polyp was lifted up to suspend in the cavity, powered on when the basement became tent shaped then cut after coagulation. For the patients whose polyps were difficult to be removed by high frequency electric knife, hot forceps were used for extraction, endoscopic mucosal resection, endoscopic piecemeal mucosal resection, endoscopic submucosal dissection or laparotomy.

Patients in the experimental group were treated with APC combined high frequency electric knife therapy. For small polyps (diameter <1 cm), APC was directly applied and for relatively bigger pedicellated and sessile polyps or adenoma, first snare was used to remove the polyps and then APC was applied to treat with the residue tissues. The argon flow was adjusted at 2.4 L/min, initial power of argon beam coagulation was at 30 W, inserted into the argon beam coagulation catheter through the scope and extended the catheter out from the head of the endoscope till 0.3 cm-0.5 cm above the lesion and subsequently applied APC by 1-3s/time.

#### **Observations**

Several parameters observed were compared and analyzed between control and experimental group which includes the average diameter of the polyp, pedunculated, basal condition, pathological type of polyp (adenomatous and non-adenomatous type), the degree of differentiation (high, medium, low), with or without lobulation. Further differences on operation completion rate, polyp resection rate at one time, complication rate and operation time between the two groups,

**Table I.** Comparisons of polyp observed between control and experimental group.

Group	Case	Average diameter (cm)	Sessile polyp	Flat polyp	Adenomatous polyp	Middle and high differentiated type	Leafless
Control	23	1.6±0.4	1 (4.3)	2 (8.7)	22 (95.7)	21 (91.3)	20 (87.0)
Experimental	33	3.4±0.5	8 (24.2)	11 (33.3)	31 (93.9)	32 (97.0)	30 (90.9)
t (X <sup>2</sup> )		3.527	3.977	4.615	<0.001	0.104	0.001
p		0.039	0.046	0.032	1.000	0.747	0.975

as well as the recurrence rate during 6-month follow-up were compared and analyzed.

**Statistical Analysis**

Statistical software SPSS 20.0 (SPSS, Inc., Chicago, IL, USA) was used for data analysis with data shown as mean ±standard deviation. The t-test was used for comparison between groups, enumeration data was presented by percentage. The chi square (X<sup>2</sup>) test was applied in comparisons between groups. The p<0.05 was considered as statistical significance.

**Results**

Comparisons on polyps performances between the two groups showed that the average diameter of polyp, the ratios of sessile and flat polyps in observation group were significantly higher than those in control group and differences were statistically significant (p<0.05) while differences on the ratio of adenomatous polyp, middle and high differentiated as well as leafless polyps between the two groups had no statistical significance (p>0.05) (Table I).

Comparisons of operation completion rate and polyp resection rate at one time in observation group was significantly higher than those in the

control group with p<0.05. The main causes of unsuccessful operation include the relatively large diameter of the polyp, the distant position of the polyp and the irregular shape of polyp. The incomplete resection at one time may be resulted because the number of polyps was too many and that submucosal invasion might exists. The operative complication rate and operation time were significantly lower than those in the control group and differences had statistical significance (p<0.05) (Table II).

Comparisons of recurrence between control and experimental group showed no statistical significance (p>0.05) (Table III).

**Discussion**

The development of colorectal cancer is a process involving multiple steps and channels. Major precancerous lesions that might be involved with precancerous lesion included adenoma, deformed crypt foci, juvenile polyps and polyposis, Paget polyps, serrated lesions and inflammatory bowel disease. Adenoma is the most important factor in the development of colorectal cancer<sup>4</sup>. Therefore, early identification and treatment were important measures to improve the surgical resection rate and survival rate of pa-

**Table II.** Comparisons of operation completion rate, polyp resection rate at one time, operation associated complication rate and operation time between the control and experimental groups.

Group	Case rate	Operation completion at one time	Polyp resection rate	Hemorrhage	Perforation	Flatulence	Tissue adhesion	Total incidence of complication	Operation time (hours)
Control	23	18 (78.3)	17 (73.9)	1	1	1	3	6 (26.1)	51.4±13.6
Experimental	33	32 (97.0)	31 (93.9)	1	0	1	0	2 (6.1)	35.6±8.7
t (X <sup>2</sup> )		4.959	4.439					4.439	5.168
p		0.026	0.035					0.035	0.033

**Table III.** Comparisons on recurrence between the two groups. The data is shown as case percentage (%).

Group	Case	Colon recurrence	Rectum recurrence	Total recurrence rate	Recurrence time (months)
Control	23	1	0	1 ( 4.3 )	5.9±0.5
Experimental	33	0	1	1 ( 3.0 )	6.0±0.4
<i>t</i> ( $X^2$ )				<0.001	0.617
<i>p</i>				1.000	0.332

tients with colorectal cancer. At present, the methods that are widely used in clinic to screen out colorectal cancers included electronic colonoscopy, fecal occult blood test, stool DNA testing, CT colonoscopy and double contrast barium enema.

Electronic colonoscopy is the first choice for diagnosis as well as treatment at the same time and is characterized for high accuracy and relatively low technical requirements. Polypectomy based on colonoscopy is also developed rapidly which includes hot biopsy forceps extraction which is applicable for polyps with a diameter less than 0.5 cm; high frequency electric snare excision which is applicable for pedunculated or sub-pedunculated polyps; endoscopic mucosal resection which is applicable for colorectal polyps with sub-pedunculated, sessile or broad base protruding or superficial lesions; endoscopic piecemeal mucosal resection which is applicable for polyps with large size and could not be removed completely at one time and endoscopic submucosal dissection which is applicable for sessile or flat polyps or polyps with large diameter<sup>6-8</sup>. At present, high frequency electric resection via electronic colonoscope has become the most popular endoscopic treatment. It could greatly improve the safety of operation and achieve complementary advantages after combining with ligation and argon plasma coagulation<sup>9</sup>. However it also has shortcomings e.g. unable to assess property of lesion, barely removes the flat colorectal polyps which leads to perforation, hemorrhage and other complications<sup>10</sup>.

The greatest advantage of argon knife lied in that it has a self-limited solidification depth. It will not cause any perforation of digestive tract if operated properly and it would be free of tissue contact while operation, thus avoiding adhesion and carbonization. So it was quite favorable for the repair of tissues<sup>11,12</sup>. Its curative value on colorectal polyps<sup>13-15</sup>. On one hand, it was more favorable for the resection of flat polyps, polyps with wide base, especially multiple polyps that

could hardly be removed by snare excision. Argon knife has a self-limited solidification depth, so argon ion beam could automatically direct to the surface of target tissues with no need to consider the possibility of perforation and bleeding. On the other hand, it could also be used as the first choice for polyps that were removed by snare excision but with long indwelling pedicle or transected end bleeding incurred from poor electric coagulation.

### Conclusions

We found that the average diameter of polyp, ratios of sessile and flat polyps in observation group were significantly higher than those in the control group, indicating that therapy combined with argon knife could broaden the application scope of high frequency electric in cutting polyps. The operation completion rate and polyp resection rate at one time in observation group were significantly higher than those in the control group and operative complication rate and operation time were significantly lower than those in the control group indicating that the combination with argon knife was safe and effective with no difference on recurrence rate. In conclusion, treating colorectal polyps by argon plasma coagulation combined high frequency electric knife could extend polyp resection, which indicates improvement in the operation effect with few complications. Hence, this technique is quite popular for its wider applications.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

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